

Amendments to the Drawings:

The attached sheet of drawings includes changes to Fig. 3 . This sheet, which includes Figs. 1-4, replaces the original sheet, including Figs. 1-4. In Fig. 3, reference numerals 134-139 have been changed to reference numerals 34-39, respectively, and reference numeral 30 has been changed to reference numeral 130.

Attachments: Replacement Sheet
Annotated Sheet Showing Changes

REMARKS

Claims 60-105 are pending in the present application. In the Office Action dated December 17, 2004 the Examiner rejected claim 60 and 62-83 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as their invention. Claim 60 was rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,634,927 to Molnar ("the Molnar reference"). Claims 61 and 84-105 were rejected under 35 U.S.C. 103(a) as being unpatentable over the Molnar reference in view of U.S. Patent No. 6,572,453 to Wijekoon et al. ("the Wijekoon reference"). Claims 62-83 were rejected under 35 U.S.C. 103(a) as being unpatentable over the Molnar reference.

The embodiments disclosed in the present application will now be discussed in comparison to the cited references. Of course, the discussion of the disclosed embodiments, and the discussion of the differences between the disclosed embodiments and the cited references, do not define the scope or interpretation of any of the claims. Instead, such discussed differences merely help the Examiner appreciate important claim distinctions discussed thereafter.

The various embodiments of the present invention are directed to planarizing microelectronic substrate assemblies on fixed abrasive polishing pads with non-abrasive planarizing solutions. A planarizing machine includes a support table, a fixed-abrasive polishing pad having a body disposed on the support table, a planarizing surface on the body, and a plurality of abrasive particles fixedly attached to the body at the planarizing surface. The planarizing machine includes a carrier assembly having a carrier head configured to hold a substrate and a drive mechanism attached to the carrier head to move the carrier relative to the polishing pad. The planarizing machine further includes a lubricating planarizing solution without abrasive particles.

In one embodiment, the planarizing machine is configured to deposit the lubricating planarizing solution without abrasive particles onto the polishing pad. The planarizing machine includes a first container and a supply of non-abrasive solution therein and a second container and a supply of non-abrasive lubricant-additive therein. A mixing site is coupled to the first and second containers, the non-abrasive lubricant-additive being mixed with non-abrasive solution at the mixing site to produce the non-abrasive lubricating planarizing solution prior to dispensing onto the polishing pad. In one embodiment, a separate container

includes the mixing site, and the mixing site is an agitator therein. The non-abrasive lubricating planarizing solution may be dispensed from the mixing site onto the polishing pad by a nozzle.

In one particular embodiment, the non-abrasive lubricating planarizing solution is formed by dissolving a lubricant-additive into a non-abrasive solution to form the lubricating planarizing solution, and then depositing the non-abrasive lubricating planarizing solution onto the polishing pad as the substrate moves relative to the polishing pad. The lubricant-additive may be homopolymers and copolymers of acrylic acid crosslinked with a polyalkenyl polyether or another lubricating liquid disclosed in the present application. The concentration of the lubricant-additive in the non-abrasive solution is selected so that the lubricating planarizing solution has a viscosity of at least approximately 4 to approximately 100 cP, and more generally between 10 to 20 cP. The non-abrasive lubricating planarizing solution provides a protective boundary layer between the front face of the substrate and the abrasive planarizing surface to inhibit the fixed abrasive from overly abrading or otherwise damaging the substrate.

In operation, the front face of the substrate is pressed against the lubricating planarizing solution and at least a portion of the planarizing surface of the polishing pad. At least one of the polishing pads or the substrate assembly is then moved with respect to the other to impart relative motion therebetween. As the substrate assembly moves relative to the polishing pad, regions of the front face are separated from the abrasive particles in the polishing pad by a lubricant-additive in the planarizing solution.

The Examiner has cited the Molnar reference. The Molnar reference discloses a support 40, a finishing element 24 that rotates in direction 4 disposed on the support 40. A finishing composition 30 is disposed between the finishing element 24 and a workpiece 20. The workpiece 20 rotates in direction 6. The Molnar reference discloses various compositions for the finishing composition 30. One preferred composition for the finishing composition 30 lacks abrasives. The Molnar reference does not appear to disclose a non-abrasive lubricating planarizing solution without abrasive particles on the polishing pad, the lubricating planarizing solution comprising homopolymers and copolymers of acrylic acid crosslinked with a polyalkenyl polyether.

The Examiner has also cited the Wijekoon reference. The Wijekoon reference discloses a chemical-mechanical polishing device 11. The chemical-mechanical polishing device 11 includes a rotatable platen 15 on which a polishing pad 17 for polishing semiconductor wafers is mounted. The chemical-mechanical polishing device 11 further includes a fluid arm 25

having a slurry/chemical polishing fluid supply line 25a for supplying polishing fluid to the polishing pad 17 from a polishing fluid source 26a, and a conditioning chemical fluid supply line 25b for supplying a conditioning fluid to the polishing pad 17 from a conditioning fluid source 26b.

The Wijekoon reference does not disclose or fairly suggest a first container having a supply of non-abrasive solution therein and a second container having a supply of a non-abrasive lubricant-additive therein. The Wijekoon reference teaches the opposite by disclosing a slurry/chemical polishing fluid supply line 25a for supplying an *abrasive* solution to the polishing pad 17. As known in chemical-mechanical polishing technology, a slurry, as disclosed in the Wijekoon reference, is a fluid including abrasive particles. The Wijekoon reference also does not disclose or fairly suggest a third container comprising a mixing site configured to mix fluids from a first container having a supply of non-abrasive solution and a second container having a supply of non-abrasive lubricant-additive. If anything, the Wijekoon reference teaches away from employing a third container having a mixing site comprising an agitator because it teaches mixing two different fluids via a single line, which presumably causes the mixing of the two fluids upon introduction into the single line. Furthermore, the Wijekoon reference does not disclose a nozzle to dispense the fluids onto the polishing pad.

Turning now to the claims, the patentably distinct differences between the cited references and the claim language will be specifically pointed out. Independent claim 60 has been amended to include some of the subject matter of dependent claim 76 and recites, in part, “*wherein the non-abrasive lubricating planarizing solution further comprises homopolymers and copolymers of acrylic acid crosslinked with a polyalkenyl polyether.*” (Emphasis Added). The Molnar reference does not disclose a non-abrasive lubricating planarizing solution having *homopolymers and copolymers of acrylic acid crosslinked with a polyalkenyl polyether*. Therefore, independent claim 60 is allowable over the Molnar reference. Claims depending from claim 60 are also allowable due to depending from an allowable base claim and further in view of the additional limitations recited in the dependent claims.

Independent claim 61 recites, in part, “a first container and a supply of a non-abrasive solution in the first container; a second container and a supply of a non-abrasive lubricant-additive in the second container; and *a third container comprising a mixing site, the mixing site coupled to the first and second containers, the mixing site comprising an agitator configured to mix the lubricant-additive with the non-abrasive solution at the mixing site to*

produce a lubricating planarizing solution, and the mixing site being coupled to a nozzle to dispense the lubricating planarizing solution onto the polishing pad.” (Emphasis Added). Neither the Molnar reference nor the Wijekoon reference teach or suggest a third container comprising a mixing site, the mixing site coupled to the first and second containers, the mixing site comprising an agitator. Furthermore, neither the Molnar reference nor the Wijekoon reference disclose employing a nozzle to dispense a lubricating planarizing solution onto the polishing pad. The Wijekoon reference teaches away from employing a third container with an agitator therein by teaching that the two fluids can be introduced via a single line, which presumably effects the mixing of the two fluids.

There is also no motivation to combine the Wijekoon reference with the teachings from the Molnar reference. The Wijekoon reference clearly teaches away from the combining with the Molnar reference by disclosing a slurry/chemical polishing fluid supply line 25a for supplying an *abrasive* solution to the polishing pad 17. The Molnar reference does not remedy the deficiencies of the Wijekoon reference. Even assuming the chemical-mechanical polishing device 11 disclosed in the Wijekoon reference is capable of dispensing a non-abrasive solution, as argued by the Examiner, the mere capability is not an indication of obviousness. As claimed in claim 61, the supply of non-abrasive solution and the supply of non-abrasive lubricant-additive are part of the overall planarizing machine, and there must be a teaching or suggestion to replace the abrasive solution of the Wijekoon reference with a non-abrasive solution. Accordingly, with the clear teaching away against using non-abrasive solutions present in the Wijekoon reference, there is no motivation to provide a supply of non-abrasive solution and a supply of non-abrasive lubricant-additive in the chemical-mechanical polishing device 11 of the Wijekoon reference as required by claim 61. (See, M.P.E.P. 2145(X)(2)).

Therefore, independent claim 61 is allowable over the Wijekoon reference and the Molnar reference. Claims depending from claim 61 are also allowable due to depending from an allowable base claim and further in view of the additional limitations recited in the dependent claims. For example, neither the Molnar reference nor the Wijekoon reference teaches or suggest the limitations of dependent claim 100, which recites “wherein the lubricating planarizing solution further comprises 0.25% by weight of homopolymers and copolymers of acrylic acid crosslinked with a polyalkenyl polyether mixed into 99.75% by weight of a non-abrasive solution comprising an aqueous solution of ammonia.”

Turning now to the rejections of claims 60 and 62-83 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as their invention. Applicants submit that the amendments to claims 60, 63, 65, 77, and 79 address the Examiner's concerns.

Turning now to the objections to the drawings for failing to comply with 37 C.F.R. 1.84(p)(5), Applicants have amended Figure 3 to include the reference numeral 130 indicating the carrier assembly 130. References numerals 134-139 have also been changed to reference numerals 34-39, respectively, which are referenced in the specification in the background of the invention and corresponded to the same components in Figure 3.

All of the claims remaining in the application (claims 60-63, 65, 76-79, and 84-105) are now clearly allowable. Favorable consideration and a timely Notice of Allowance are earnestly solicited.

Respectfully submitted,

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MS:clr

Enclosures:

- Postcard
- Check
- Fee Transmittal Sheet (+ copy)
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